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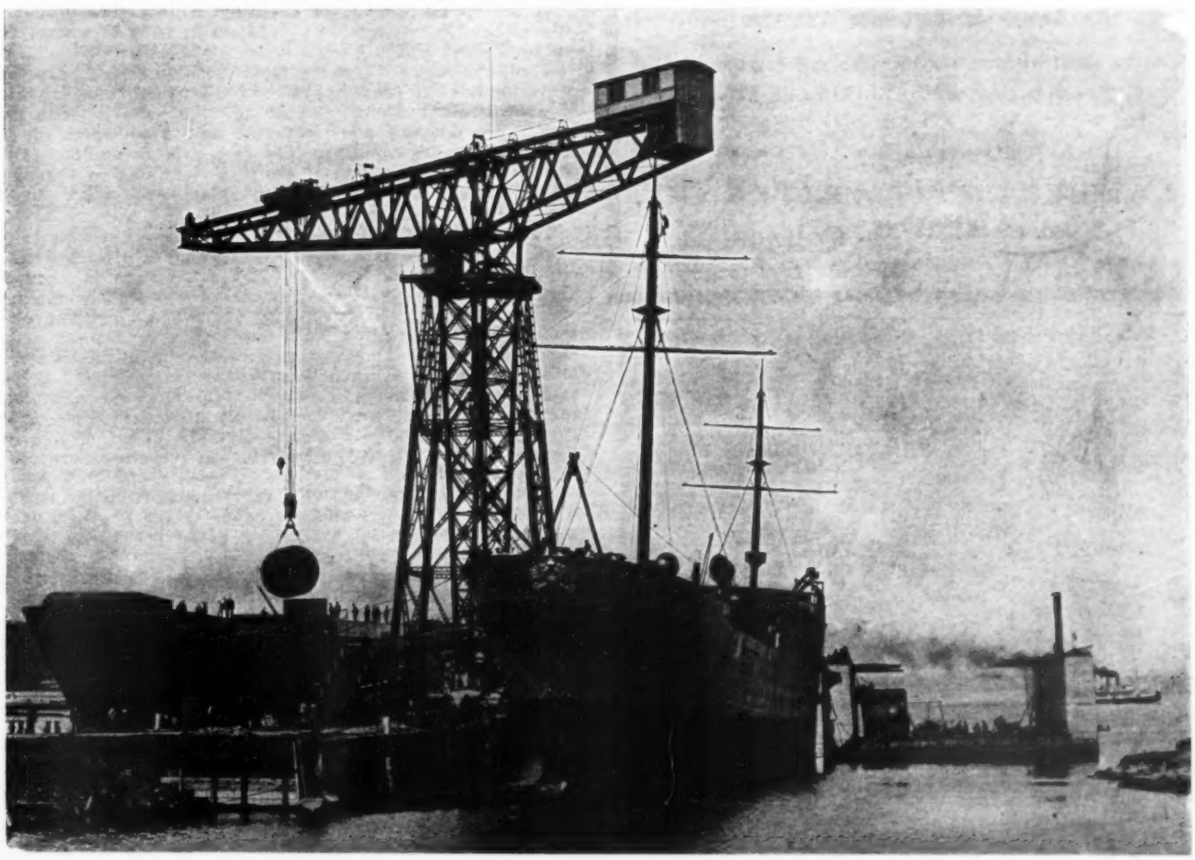
Largest and Most Powerful Crane Ever Built



Colossal Electrical Hoist in the Harbor at Kiel That Can Lift 50 Tons of Steel Armor Plate at One Time--See Next Page

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Trains Run Through Buildings.
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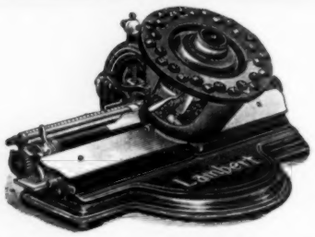

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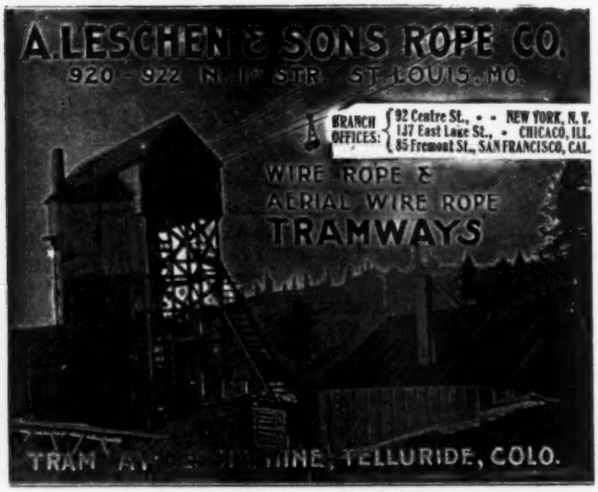
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THE LARGEST CRANE IN THE WORLD.

Two of the Largest Vessels Afloat May Load or Unload on Either Side.

The largest crane in the world is the one shown in the illustration. It is situated in the harbor at Kiel, Germany, and is run by electricity. It is so arranged that two of the largest vessels afloat may steam up on either side of it for the purpose of unloading or exchanging cargoes. The crane is powerful enough to lift 50 tons at one time. It has been only a few years since hand cranes were used in German ship yards and on the harbor docks. These were later replaced by steam cranes and now by electric cranes which are not only in use on shore but all the large German passenger steamers are fitted up with them. The building of immense cranes like the one shown in the illustration is the result of the shipment of great masses of armor plate, heavy machinery, boilers and smokestacks which have to be moved from the docks on shipboard.

A shrimp-canning factory will be built on floating barges at Ocean Springs, Miss.

SAPPHIRE MINING IN MONTANA.

The Most Valuable Gem Mines in this Country—Yogo Mines Produce Large Quantities.

The blue sapphire and the gem known as the cornflower blue sapphire are the most highly prized of the group or stones which are classed as sapphires. From these decorative gems the substance composing them runs all the way in grade down to ordinary corundum for commercial purposes.

The substance of sapphire is native alumina. When in hexagonal crystals of bright blue it is called sapphire, when red it is known as oriental ruby and when found in rough masses it is named corundum, the hardest of crystals next to the diamond, when mixed with magnetic iron ore it is known as emery.

Eighteen miles northeast and east of Helena, Mont., valuable beds of this substance were discovered in 1873 by miners who were seeking for gold but it was not until 1891 that operations began for properly mining this product of the earth. The sapphires are found in beds of gravel from 10 to 50 feet thick.

The Yogo mines where the most valuable deposits are found were intended to produce gold and the placer company which dug the ditch spent $38,000 in the effort. The clean up of the season's work revealed only $700 worth of gold. The sluice boxes contained, however, a large number of blue stones. A cigar box full of the gems was sold to Tiffany for $3,700 and steps were taken to enlarge the work in the search for gems.

The methods of extracting the sapphires is similar to that used by placer miners in sluicing for gold. The bed of the sapphires is called "magma" and great care is necessary that the force of the water does not wash away the gems which have less specific gravity than gold. The process of disintregration occupies from one month to a year, according to the hardness and tenacity of the "magma." When the stream of water is turned upon the magma beds it tears them into small lumps which disintegrate in the air. When the "clean up" is effected, rockers are used with three screens through which the pay dirt is passed. When it has thus been worked down to the finer screen the stones are picked out by hand.

The stones of the Yogo vein vary in size from the smallest to four or five karats and are equal to the products of the best mines of India. The largest stone yet found weighed nine karats.

The product for one year runs from 60,000 to 200,000 karats. The American Gem Mining Company has a shop in Helena where 15 men are employed in cutting the stones. Altogether the output of precious stones is a very considerable addition to the industries of Montana.

TAR MACADAM ROADS CHEAP AND ENDURING.

Tar-macadam roads in Ontario, Canada, have proven a great success. They are especially adapted to a country where stone is scarce, and as they cost from one-third to one-half less than asphalt or vitrified brick, and last longer, this method of making good thoroughfares is also desirable in the towns and cities. The cost of construction of the best of tar-macadam roads is 68 cents per square yard. It is estimated that they will remain in good condition for at least ten years, when, if necessary, they can be resurfaced at a cost of 25 cents per square yard. It is claimed that the tar-macadam road is almost as noiseless as asphalt, that it is easier on horses, with less jar and danger of slipping in wet weather, and it is further an almost dustless road.

In the construction of one of these roads, 12 inches of tar-macadam is placed on the subgrade. The bottom course or stone foundation consists of large stones, varying from 6 to 12 inches, laid roughly by hand on their flat beds. The voids in the foundation are then filled with smaller stones and rolled. The broken stone for the second course is thoroughly coated with tar, laid to a depth of five inches and rolled as soon as possible. The top course consists of gravel screened through a ¾-inch mesh, mixed with tar and rolled. The screenings of the crusher may be used on top to harden the surface and to give a more pleasing color than that of the black tar.

The Republic of Colombia has the finest emerald mines in the world.

The principal rivers of Russia are all connected by canals.

Wireless Telegraphy May Lead to Other Mysterious Powers

Burning Houses and Exploding Powder Magazines Miles Away Are Within the Range of Future Developments

When Marconi sent his first wireless message across the Atlantic did he mark the beginning of a new era of wonderful and mysterious events? Will the development of his idea along the lines, already successful, lead to the manipulation of a seemingly occult force? To burn a house miles distant, to cause a flame of fire to suddenly flash within the carefully guarded walls of the powder magazine of some great battleship would seem as near an approach to genuine witchcraft as anything could be. All this is not absolutely promised, but it is more than hinted at by advanced electricians.

In the early days of the telephone, and even yet in many cities, instead of using two wires and what is known as the metallic circuit, one wire is dispensed with, and the earth or ground return is used instead. The service however cannot be compared with the two-wire system, and is subject to all kinds of buzzing noises and interruptions, the exact cause of which no one can locate. Some other stray electrical current darting along through the earth gets mixed up with the telephone message and comes into the receiving instrument.

When electric railways were first built they too used the ground return. As their current was a very powerful one it raised the mischief with telephone lines trying to use the same "ground." The courts however declared the ground free for all. The railway current had a bad habit of straying a long ways from its proper path and so much of it never did get back to the power house that on a large road it meant thousands of dollars' worth of coal burned to no purpose, except a bad one, for often the lost current would attack water and gas pipes and eat holes through until the pipes leaked like a honeycomb. As a matter of economy the electric railways had to provide a metal return for their current and are using the rails of the track for the purpose.

The foregoing history, well known to all electricians, is used as a basis of comparison by J. B. Baker, in an extremely interesting and somewhat guarded article in the Electrical Review, New York. He asks what is likely to happen when the strong current intended to hurl a message through the three thousand miles of space becomes, accidentally or intentionally, impaled on some electrical conductor near at home.

"The electric radiation of power to work a coherer across the 3,000 miles of the Atlantic may now be sufficient to develop visible spark across an air-gap in the receiving system now located within three miles, or one-thousandth of the distance.

"If we further conceive that spark-gaps existing in an accidentally attuned circuit, such as the open-space lightning arresters, if it is a telephone or telegraph circuit, or a narrow break in some open translating device or a loose joint in the wiring, we have an opportunity for a fire whose origin would certainly be of the mysterious class.

"It has been rumored in the electrical press that the operation of Marconi's big Cornwall station effectually "drowned out" other wireless experiments in his vicinity in the United Kingdom in spite of the exact selectivity claimed for the apparatus at that station. The newspaper items printed at the time of the transatlantic demonstration at Wellfleet, Mass., stated that the telegraph and telephone service in the vicinity was put out of order by the wireless tests. In Fahies's books on the history of wireless telegraphy is described the effect of a thundertorm upon the operation of an electroplating establishment. The vat wiring was full of bad joints, and although this system of wiring was certainly not attuned, in the pariance of the day, the coherer effects of the flashes of lightning in the vicinity were sufficient to make minute welds at the joints in the wiring, which, by lowering the resistance, caused an excessive current to pass through the electroplating solution, making it 'boil' and spoiling the work. Finally, to show that the possibilities of setting up such forced oscillations was thought possible by some, it was proposed in the early days of wireless telegraphy, and has since been revived, to explode the magazines of a hostile warship by sparks developed therein, or to melt the armor plate on the same unfortunate vessel by sympathetic or forced electrical vibrations.

"All these stray thoughts are not to be taken seriously by themselves alone, but are indications of an underlying ever-real set of phenomena containing elements of conflict with existing electrical distribution systems which should be anticipated and provided for against the day of the general use of transmission of electrical energy through space without wires for the telegraphic or telephonic signaling, or the transmission of power."

Pretty Bridge on the Pennsylvania

Ohio River Span at Steubenville is Noted for Its Artistic Appearance

Not remarkable for its ponderousness, size, cost or peculiarity of construction, but for its exceeding grace and picturesque appearance is the Pennsylvania bridge that spans the Ohio river at Steubenville. The structure has eight spans, however, and is nearly 2,000 feet long. Stretching across the famous old river at one of its most beautiful points the scene with the valleys and hills, the swift flowing torrent and the bridge in the foreground presents a picture of rare attractiveness. The structure is of iron and stone and built very strongly. The central span, as will be noted, is supported from above instead of below, in order to permit the passage of boats.

Ohio River Bridge at Steubenville, O.

NEW PRINTING PROCESS.

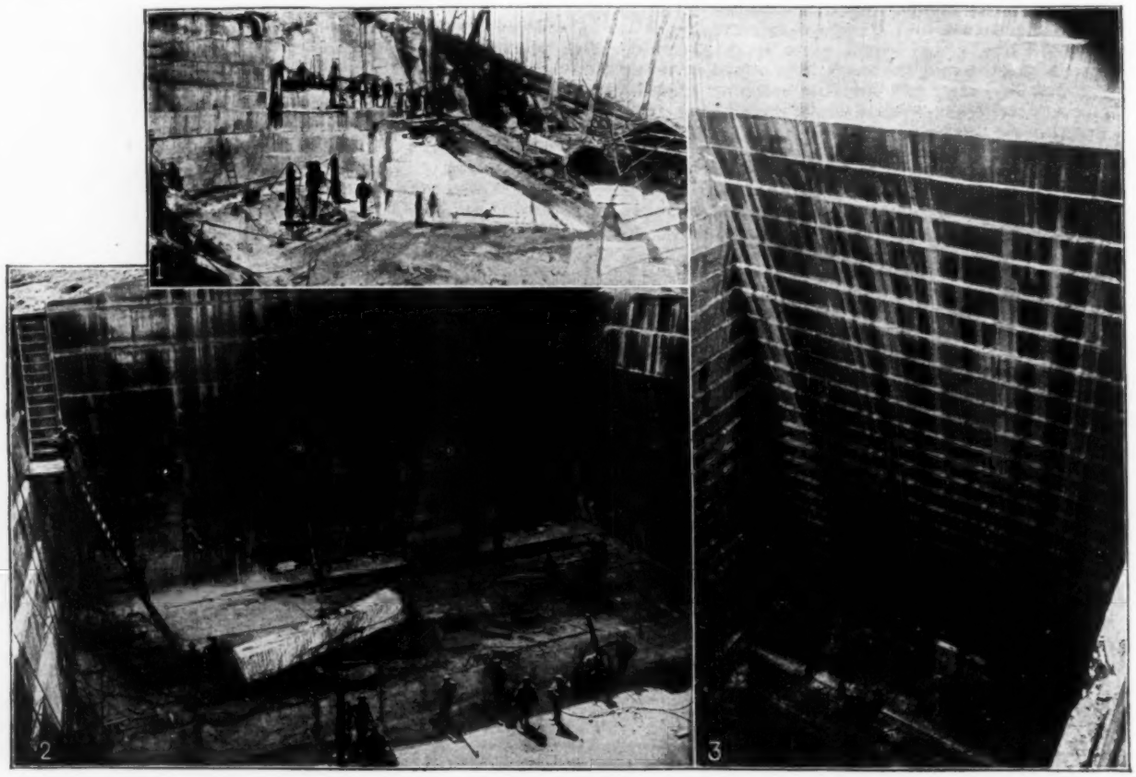
Italian publishers and newspaper proprietors are seriously interesting themselves in a new process of printing, for which important claims are made. The Tribune, of Rome, states that a Genoese firm has acquired all rights in the new process, and that a few weeks since all the proprietors and leading printers of Milan assembled to witness a series of practical tests, which are all described as having been perfectly satisfactory. The invention consists in the substitution of celluloid for preparations of lead and antimony, and gives an admirable reproduction from all kinds of plates and blocks.

MARBLE QUARRYING IN GEORGIA.

Inexhaustible Supply of Valuable Stone 60 Miles Long and 150 Feet Deep.

Since 1893 marble quarrying in Georgia has had an impetus that bids fair to place her in the first rank of marble producing states. The marble belt is about 60 miles in length, extending in a south-westerly direction from the North Carolina line in Fannin county. The greatest output is produced in Pickens county. The supply of marble in Georgia is practically inexhaustible as the depth of the deposit in many places is over one hundred feet. The Georgia Marble Company's quarry No. 1, shown in the illustration, is nearly 150 feet deep.

Naturally so large a belt as that in Georgia produces a large variety of marble, but most of that quarried is of an excellent quality. Both white and colored varities are found. The characteristics of the Georgia marbles are purity of chemical composition, uniform texture and peculiar crystalline structure. According to The Monumental News these properties render it remarkably durable and strong, with a very low absorption of water under the most trying tests, while at the same time making a beautiful material for interior decorative work. An especially fine feature of this marble is that when washed off its color and freshness is practically renewed.



Georgia Marble Quarries.—No. 1, Southern Marble Co.'s Quarry, Marble Hill. Nos. 2 and 3, the Georgia Marble Co.'s Creole Quarries at Tate Gad. The latter is nearly 150 Feet Deep

SPODUMENE AND NITRATE DEPOSITS.

Spodumene is found in several places in America, the richest mine being at at the Etta tin mine near Keystone, South Dakota. Spodumene is a whitish crystal which resembles logs of petrified woood, having a similar grain. It is found in pockets, and is mined by open cuts. Frequently a pocket will be struck containing several tons. It is mined for its lithia values, the material containing about 5 to 6 per cent lithia.

The nitrate deposits of California are situated in the Mohave Desert, extending from the northern portion of San Bernardino county to the southern section of Inyo county, and are 80 or 100 miles from Manvel, on the Santa Fe Railway. Some very high analyses of the mineral are reported, and it is estimated that there are about twenty-two million tons in sight, though it is thought that these figures are likely to be modified when active mining is in progress.

WHY STRONG SWIMMERS OFTEN DROWN.

Are Frightened by Cramps—Parents Err in Teaching Children to Fear Water

Every week we read of strong swimmers being drowned from cramps. This is a useless waste of life, for if the swimmer will maintain his composure there is no reason why he cannot keep himself afloat when thus afflicted. The trouble with the swimmer is he becomes frightened; he loses his nerve. Cramps are not serious to the cool headed person. Usually it affects only an arm or a leg, or, maybe, only a hand or a foot. The average opinion is that the swimmer who is attacked while swimming in deep water is as good as drowned. This very prevalent wrong idea is the cause of the great amount of fatalities in the water. When the swimmer feels a leg or an arm begin to cramp he becomes frightened. He loses his wits, begins to splash and paw and struggle and then goes down. The swimmer should remember that he can easily keep afloat with one arm, one leg or without the use of either, if he will turn on his back and keep his chest inflated. It is a simple matter of floating which is very simple. If the cramped person will keep cool and float the cramped limb may soon relax and he will find himself as well as ever. The great trouble comes from the erroneous practice of many parents, especially those residing in small inland towns, to teach their children from infancy to fear the water.

AMERICAN IDOLS FOR CHINA.

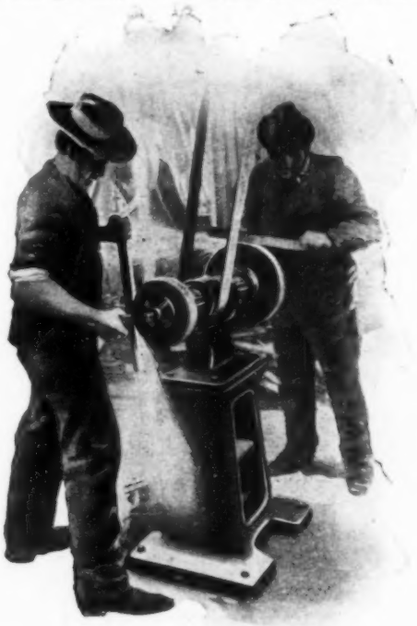
American enterprise has done much to almost completely stamp out the manufacture of heathen idols and gods at Birmingham, England, which for generations was noted for its trade in this line. During the past ten years the manufacture of idols in the English city has so fallen off that now only small orders are received, and they are handled by the little factories. By reason of the decrease of this particular industry in Birmingham, manufacturers on the continent are profiting proportionately. That Christian America is coming to the fore in producing these images is shown by large contracts recently given to Philadelphia and New York houses for the manufacture of Chinese and Corean idols. These idols and bibles frequently are shipped in the same cargo.

Building An Automobile

America's New Industry That Has Grown to Wondrous Proportions of Recent Years

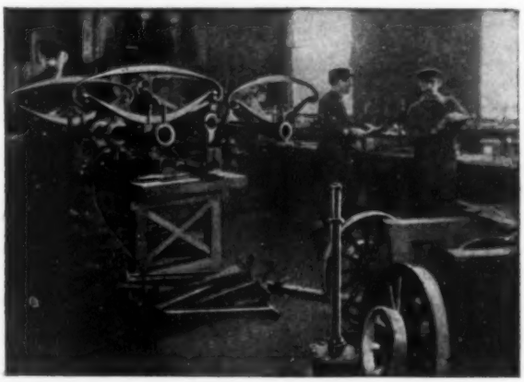
Building an automobile is a more tedious and laborious job than the unknowing would imagine from seeing a trim, completed vehicle speed along with all its multi-formed parts in working order. Take all the machinery apart and the novice would think there were enough strewn about to make three or four automobiles. From a few insignificant shops the manufacture of automobiles in the United States has grown to a mammoth industry employing thousands of workmen in great factories of the finest and most modern machinery to be found in the country.

In the up-to-date automobile factory will be found several draughting rooms, pattern shops, upholstering shops, numerous machine shops, erecting floors, tin shop, assembling rooms; and many other departments. Every different kind of work finds its special machine in the small tool department. In the making of a modern gasoline machine the ex-



Dressing Up Section of Steel Frame

haust valve hole is bored and the seat made at one operation. There is a machine for planing 30 counterbalance weights at one operation. Every hole is bored in the gear case at one setting. Every gear case is bored in the same jig; each one is dead right and all are interchangeable. There is a special machine of skilled mechanical construction for boring cylinders, a job about which there can be no guess



Department for Assembling Front and Rear Axles

A Brazing Forge

work. Ten surfaces are milled at one operation. Upon the accuracy of this work depends the relation of the crank shaft to the cylinder. The illustrations shown and instances here related pertain to the manufacture of Packard Motor cars.

"The Baby" Steam Hammer Working Out a Special Gear Wheel Blank

The pictures are from photographs taken at this factory while the work of building the gasoline motor cars was in progress.

LARGEST PLATE MILL IN THE WORLD.

The new plate rolling mill which is being erected in the works of the Carnegie Steel Company is said to be the largest in the world, and it is now well advanced. Plates up to 11 ft. 8 in. in width will be rolled. Plans are also being prepared for the enlargement of the Howard axle Works of this establishment to accommodate the massive machinery necessary to produce the rolled hollow car axle, the manufacture of which is to be undertaken by the Carnegie Company.

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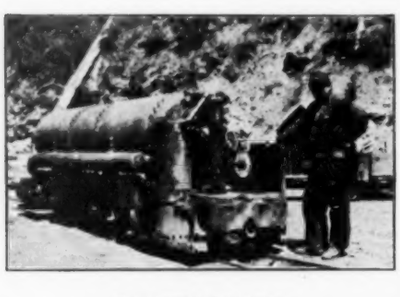
ELECTRIC TRANSMISSION.

A Mexican electric transmission line is to be run on steel towers instead of on wooden poles. The Guanajuato Power and Electric Company's line is 105 miles long, and will work at 60,000 volts, three-phase, says Engineering News. In all high-tension transmission lines the insulators are the weak points, and in this case the number of these weak points is decreased by using long spans of conductor between supports. In the present case a span of 440 feet was adopted. Iron cross-arms and iron insulator pins will be used, and porcelain insulators. The conductors are nineteen-strand copper cable.

COMPRESSED AIR ENGINE FOR MINES.

A compressed air engine in the Red Point mine, Placer county, Cal., takes the place of horses or mules in hauling the empty cars up the four miles of grade into the mine. The accompanying photograph, taken by A. Sheldon Pennoyer, shows the engine. It carries



Compressed Air Engine

800 lbs. pressure to the square inch, but runs on only 150 lbs., a check valve regulating the pressure to the cylinder. The track guage is but 18 inches.

The air compressor is run by water power and is located a mile and a half down the mountain side. The engine requires a half-hour to make the trip into the mine and air is taken three times on each trip.

"Looping the Loop" An Old Pastime

"Looping the Loop" is not such an up-to-date pastime as it seems. L'Illustration of Paris discovered in its issue of September 12, 1846, the picture of an identical device in use at that time. This picture is here reproduced. A little further research, according to the Scientific American, has revealed the fact that one Clavieres was the inventor of the centrifugal railway, which was no doubt as much of a sensation then as it is now. Clavieres, in order to convince the people that his "loop-the-loop" was safe, filled his cars with monkeys which made the trip without injury.

Clavieres' centrifugal railway, or "aerial" railway, as it was then called, differed but little from the present "loop-the-loop." The track, after a sharp descent, was curved into a circular loop and then extended into an upward incline. The car, in traveling on the two rails constituting the track, plunged down the first incline at terrific speed, whirled around the loop, and ascended the second incline.

Looping the Loop in 1846

How Cut Glass is Made

Cut glass articles are so expensive that most people are unable to own them. Many persons wonder why they cost so much. The high prices are due to the time required to turn out a perfect article and the skill necessary to do the work. Cut glass can be made from but one kind of sand. This is nearly all silicia and is found in the Berkshire Hills and in one place in Russia. This sand is quite valuable and forms a considerable part of the expense. It is almost white and as fine as the best sugar.

The sand is mixed with red lead, potash, saltpeter and other minerals and heated to a temperature of about 300 degrees. When melted it forms a beautiful rose-colored mass that is ductile but not fluid. From this mass the blower blows a "blank" in the form of the article desired. This is gradually cooled in a furnace. When it is cool enough to stand ordinary temperature the "blank" goes to the marker, who draws a design or pattern on it with red lead. Workmen are often paid from $25 to $100 for one of these designs if it proves popular when they are put on the market.

The next workman is called the "rougher," and he must be very skillful. He serves an apprenticeship of five years. This man holds the lines of the pattern against a revolving steel wheel covered with fine flint sand. This grinds the pattern into the glass. The "rougher" must cut his lines to just the right depth, neither too shallow nor too deep. When he has finished his part of the work it goes to the "smoother," who uses a stone wheel in place of one of steel.

The smoother goes over the lines just as the rougher did and then the glass goes to the polisher. This workman uses a wheel of wood covered with pumice stone. He must use the greatest care in polishing the glass or he will ruin it. It takes about three weeks to finish a punch bowl. Very little fine cut glass is kept in stock, most of it being made to order, especially the large pieces.

DOG RIDES A WHEEL.

While this dog is not a bicycle rider, he has been trained to balance himself on the wheel so nicely that he can steady it long enough to allow a photograph to be taken of himself on his master's bicycle. He is a five-year-old spaniel belonging to Mr. J. B. Fisher, of Westchester, Pennsylvania, and frequently accompanies Mr. Fisher on his wheeling tours. When this photograph was taken the bicycle was not fastened in any way.

Matt on His Bike

Uncle Sam's Home at the World's Fair

THE UNITED STATES GOVERNMENT BUILDING designed by James Knox Taylor, supervising architect of the treasury department, will be one of the most beautiful conceptions at the St. Louis World's Fair. A great flight of steps 100 feet wide and adorned with statues will lead to the central pavilion. A dome 93 feet in diameter, similar in general character to the dome of the Pantheon at Rome, will surmount the center of the structure. The building will be rectangular with projecting pavilions. The interior floor area will be 175 feet by 734 feet, entirely free of columns, the roof being carried with steel trusses 275 feet in span, 70 feet high and 35 feet apart. The sculpture will be symbolical of the Republic and the arts of peace. The cost will be $450,000.

FOR A SUBMARINE TROLLEY LINE.

New Yorker Has a Unique Device Proposed for Passenger Traffic Across the English Channel

A submarine trolley line for conveying passengers across the English channel may be constructed for the utilization of a patent owned by Albert Krimmert of New York. The device is the invention of Karl Leps, a German engineer. Mr. Krimmert is making a vigorous propaganda for his plan of connecting Dover and Calais by means of this unique submarine boat line. He declares that the new invention would do away with the present numerous inconveniences and even dangers of a packet boat passage across the channel, the seasickness, the frequent interruptions of traffic by storm and fog and the risk of collisions.

This submarine trolley boat is made of strong steel plates and is 150 feet long. At both ends are observation windows with strong glass lenses. It contains three electric motors of 500 horse-power each for the running of the propeller or propellers, and two motors of 50 horse-power each for running the cable wheels. On each side of the boat there are four grooved wheels with safety ratchets and holders over which the guide cables are to run. The cables are to be either stretched from Dover to Calais, somewhat like the trolley wires of an electric street car line, or are to rest upon the bottom of the sea, to be raised only as one of the boats running at a certain depth below the surface passes on its way from terminus to terminus. The stations are to be provided with U-shaped tracks, with the lower part of the U above the water line and the two arms extending obliquely underneath the water. Upon the arrival of a boat it is to be drawn up out of the water on one side of the U and unloaded when it has reached the turn of the U track. The inventor also considers it feasible to make the guide cable a power cable by making it endless and running it over rotating drums at either end of the line. By that arrangement he thinks the speed of the boats could be greatly increased. Mr. Krimmert estimates that the establishment of such a line between Dover and Calais would not cost more than $16,000,000 and the profits, he says, would be enormous.

LEFT HIS EYE TO WATCH NATIVES.

A prospector of Rhodesia, who had a glass eye, being wishful to get away for a day's shooting, hit upon an ingenious expedient for keeping his native laborers up to the mark during his absence. Knowing that they would cease work as soon as his back was turned, he called the "boys" together and told them that, although he himself would be absent all day, he should leave one of his eyes behind to see that they did their work. Much to the surprise and bewilderment of the natives, he suited the action to the word and, taking out the glass eye, placed it on the stump of a tree and walked off. For sometime the Kaffirs worked like elephants, now and then casting furtive glances at the eye to see if it was still watching them. At last one old Kaffir put down his shovel and, picking up a bucket, approached the tree stump and gently covered the eye with the bucket. As soon as the gang saw that they no longer had the boss' eye upon them they lay down and slept peacefully until sunset.

NOISELESS STREET RAILWAY CROSSINGS.

A practically noiseless street-railway crossing is one of the latest achievements. Instead of the metal plates fitted in the crossing portions of intersecting rails or crossing castings, as at present, blocks of wood or fibrous material are used in the new crossing. This construction is what makes the crossing noiseless. The fibrous block is formed so that when it is in position the grain will run vertically and present the uncompressible ends at the upper and lower faces. These blocks may easily be removed and renewed with small expense.

TWIN-SCREW FIRE BOATS.

Pilots on the Columbia river favor twin-screw steamers with steel hulls for fire boats. They claim that a twin-screw boat could be handled much easier than a single-screw or a stern-wheel boat. With twin screws it is possible to turn a vessel in its own length. They believe the fire boat should have a steel hull, to give greater rigidity for the massive pumps with which it must be installed.

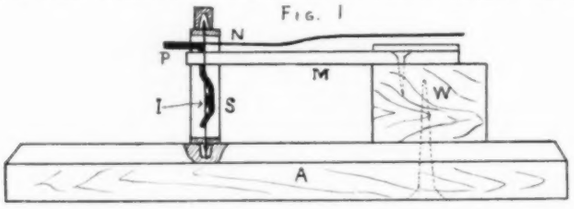
Easy Electrical Experiments

By L. P. Dickinson

A PORTABLE VOLTMETER.

Voltmeters are instruments for measuring the voltage, or electrical pressure, between two points of an electric circuit. Some voltmeters are designed to be used in one position, while others are designed to be carried about, and to

Fig. 1



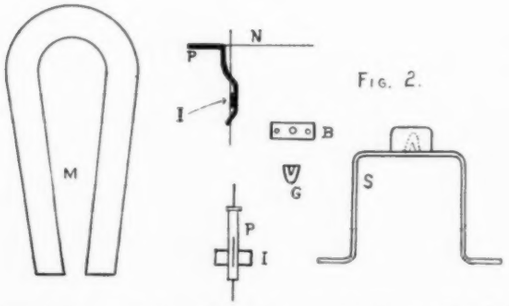


Fig. 2.

give essentially correct readings in any position. The latter are harder to construct than the former, but as may be readily seen, they have a wider range of usefulness. In the following chapters directions will be given for constructing a portable instrument, the form of construction adopted being one that has been proved by experiment to be perfectly practical, and easily constructed by a person with few tools. There will be needed for the base of the instrument, a piece of well dried cherry 6¼ inches square and ⅞ inch thick. It is well to take considerable pains in finishing this up so as to make it perfectly smooth and true. The edges should be beveled, as shown in Fig 1. To this base is to be fastened, on its upper side, a block of wood 1¾ inches long, 1¼ inches wide and ⅞ inch high. This block is fastened by two heavy screws, as shown at W, and is so placed that the center of the block is on the center line of the base, and the outer edge of the block is ⅞ inch from the edge of the base.

Now procure an ordinary 3-inch horseshoe magnet. This is to be secured firmly to the upper side of the wooden block by a clamp made from a piece of stiff sheet brass through which a screw passes into the wooden block, securely clamping the magnet in place, as shown at M.

We will now proceed to construct the movable part of our instrument. There will be needed first of all a large-sized sewing needle about 2 inches long. The eye-end of this needle should be broken off and ground to a fine point so as to make a needle 1½ inches long. We wish to secure to this needle a small thin piece of soft iron, as shown at I in Fig. 2. A very simple way to do this is to cut out a long narrow strip of thin sheet brass, such as is shown at P in Figs. 1 and 2. By means of two holes through this piece near one end, which are just big enough to allow the needle to pass easily, the piece of iron may be secured firmly in place and by forcibly bending the brass strip, the latter will bite the needle hard enough to prevent the whole from turning easily upon the needle. The upper end of this strip is bent over at right angles at a distance of 5-16 inch from the upper end of the needle. The object of this bend is two-fold. First, it is to be used to support the pointer N by being bent around the latter, and for this reason the strip at this point should be cut rather wide, say ⅛ inch. Second, the weight of the projecting part of the strip is designed to counteract the weight of the pointer so as to form a moving system which will be nicely balanced.

To support the needle we will need a piece of brass about 5-16 inch wide bent into the shape shown at S. The height of the under side of this brass support is about 1 3-16 inches above the base. A small block of brass is shown fastened to this strip. This block serves as a support for a bearing made of glass which greatly diminishes friction.

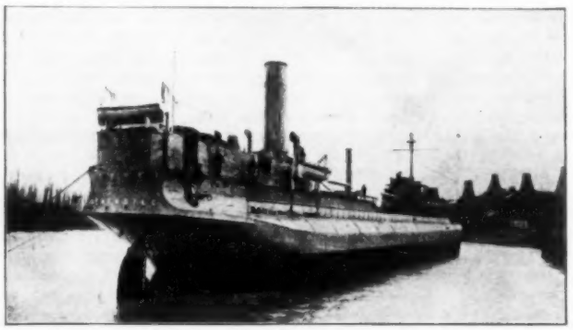
To make these glass bearings procure a piece of very small glass tubing such as chemists use. Insert one end into a gas flame and heat it until the end softens and runs together. If the tube be held vertical and allowed to cool, the outer end of the tube will be rounded and the inner end of the tube where it is closed up will taper down to a point. If now the end of the tube be cut off so as to form a piece about ¼ inch long there will be formed a piece of glass something like that shown at G, Fig. 2. The glass tube may be cut by making a deep incision on one side of the tube with a sharp file. If the tube be held in the hands, with the thumbs held on each side of the scratch, the latter being on the opposite side of the tube, then the tube may be easily snapped off. Two such bearings will be required, one held in the brass block as already described, the other fastened into a recess in the wooden base, and held in place by a small piece of brass, B, screwed to the base. Of course holes must be bored through the brass strips, B and S, so that the needle may pass through them, but not large enough to allow the glass bearings to slip out of place.

The needle should be supported in such a position as to pass vertically between the poles of the horseshoe magnet at a distance of ⅛ inch within the latter. The needle N is made from a slender straight piece of broom corn taken from an ordinary whisk broom, and is secured as has been explained by bending the end of P over until it clamps the needle. The needle may be made about 4 inches long at first.

We will continue the discussion of this instrument in our following chapter.

ABOUT TURRET STEAMERS.

It is now about ten years since the first turret steamer, the "Turret," was built. Since that time many improvements have been made in this type of vessels so noted for their great carrying capacity. The "Turret" was built for carrying coal and ore. Her dimensions were 280 ft. by 38 ft. by 22 ft. 9 in. She carried 3,200 tons dead weight on 18 ft. draught, her net tonnage was 1,265 tons and her cargo capacity 158,000 cubic feet. The latest vessel of the turret style, the "Argyll," is built for carrying general cargoes so that she differs from the "Turret" in general arrangement. Her dimensions are 340 ft. by 45 ft. 6 in. by 27 ft. 3 in., and



The S. S. "Turret," First of Turret Steamers.

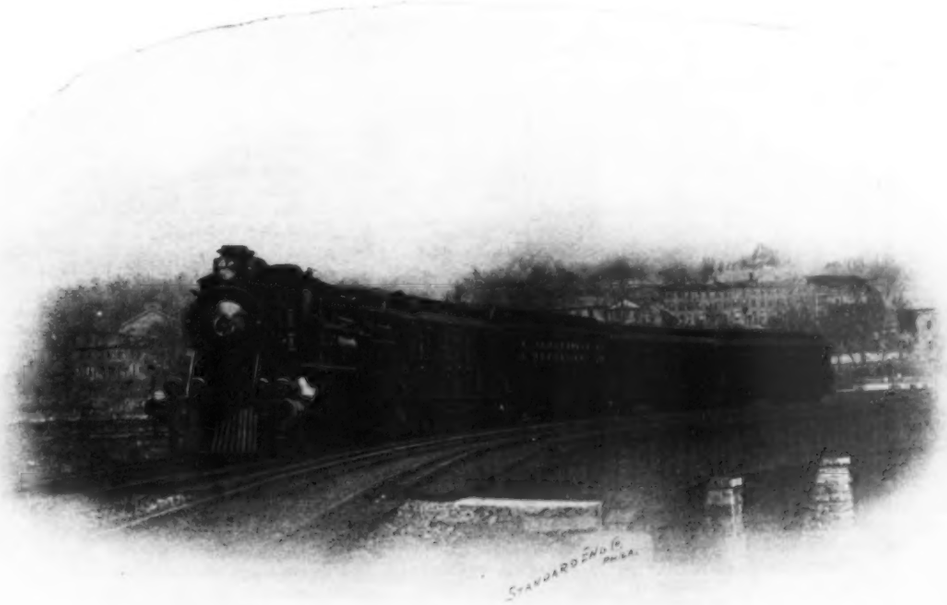
she carries 5,800 tons on 22 ft. draught. Her cargo capacity measures 300,000 cubic feet and her net tonnage is 2,277 tons.

The cargo space in the "Argyll" has been increased nearly two-fold over the first vessel of the kind, and still further economy is being made in the manufacture of new turret steamers. These new vessels are 350 ft. by 50 ft. by 25 ft. 3 in., will carry 6,150 tons on 21 feet draught, and will have, besides the bunkers, a cargo capacity of 325,000 cubic feet, and a net register the same as that of the "Argyll." In the recent make of turret steamers there is space on deck for cattle and sheep. This deck is about 12 feet above sea line and in from the side of the boat about 10 feet so that live stock is carried safe and dry. The Shipping World, London, says these turret steamers are equipped with triple expansion engines of large power which give them a speed of nine knots.

HOW THE "ROYAL BLUE" LINE GOT ITS NAME.

Was the Chosen Route of Aristocratic Families in the Early Days

The Royal Blue line was so named because of the aristocratic passengers that patronized it in the early days. The coaches were painted royal-blue, and at one time it was considered the handsomest train in America. The line is the New York, Philadelphia, Baltimore & Washington railroad, and is yet one of the most favored routes between those points. The trains are very handsome and lately the road has been equipped with engines of superior modern make. The engraving shows an up-to-date train of the famous "Royal Blue", running between New York and Washington. The locomotive is of the Atlantic type built for the Central railroad of New Jersey. The view was taken as the train was crossing the falls of the Schuylkill, Philadelphia.



Royal Blue Line Train Crossing the Falls at Schuylkill

A MIRACULOUS ESCAPE.

H. Hervey, formerly in the government telegraph service in India, tells of the miraculous escape of a half-caste operator from death by a flash of lightning. It was before improved metal lightning dischargers had been installed for use in office circuits and a deficient arrangement was interposed between the outside line and instrument.

"One day at Madras during a thunder storm," writes Mr. Hervey, "the electric fluid destroyed one of these deficient affairs, and while a fresh one was being procured the head signaller temporarily joined over 'direct' to save delay. It was the Bezwada instrument and a half-caste lad named Curtis was seated at it sending and receiving messages. Suddenly from where I sat in an adjoining room, I heard a sharp crackling sound and saw Curtis spring from his stool and whirl round and round till he was brought up with a 'thud' against the wall. After ascertaining that the boy was not materially injured, we examined the instrument and discovered that the relay coils had entirely disappeared, burnt out in fact by the lightning, while the same agency had struck Curtis whose fingers happened to be resting on the brass part of the handle. Subsequent search under the table disclosed a solid 'splash' of copper, representing the entire metal of the relay coils fused into one mass."

An electric street sprinkler, costing $3,000 and which will lay the dust on ten miles of street in an hour, has been invented by a Parisian engineer.

LARGEST OIL SHIP AND STRONGEST VESSEL.

Remarkable British Craft Built for the Anglo-American Oil Co.'s Fleet

A natural product of the increasing supply and commercial importance of oil is the leviathan British oil ship Narragansett, which has just been launched in the low reaches of the Clyde. More than 530 feet long, 63 feet 6 inches broad and 42 deep, the Narragansett is the largest bulk oil carrier ever built. The number and arrangement of the subdivisions are such that no storm that ever blew on any waters could possibly sink her. Not only is she the finest and largest oil carrier, but the vessel is said to be the strongest, most rigid structure that floats. All cooking on board is done by steam and electricity to avoid fire risk.

The Narragansett has a gross tonnage of 11,000 tons, deadweight carrying capacity 12,500 tons and displacement at load draft of 21,000 tons. There are more than 1,250,000 rivets in the colossal craft, and it took more than a year's steady work to build her. She has four great pumps which are capable of discharging 900 tons of oil per hour, or the whole cargo in about 12 hours. Throughout the vessel is heated by steam. The machinery is all exceedingly massive. There is a set of triple expansion engines of 5,500 horsepower. Steam is generated in six large single-ended boilers, which are placed three abreast and fired from two stokeholes. They have Morrison's corrugated bed furnaces and the working pressure is 200 pounds per square inch. Natural draught is used and the contract speed of the vessel is 14 knots. The ship was built for the Anglo-American Oil Company and is to float on the Atlantic.

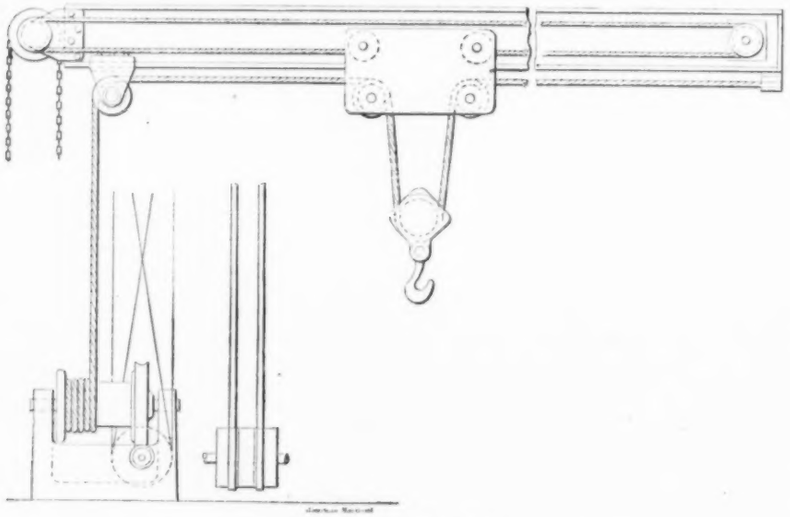
HOW TO CLEAN EGGS.

Clean eggs look much better and sell much better than dirty eggs, but there is a proper way to clean them. Eggs, however, should not be washed off, except as a last resort, for the reason that water removes from the shell a mucilaginous covering which renders the shell impervious to air. When this covering is removed the keeping qualities of the egg are destroyed. An egg, if only slightly soiled, should merely be moistened and rubbed dry. If the egg is stained a little powdered scouring brick will usually suffice, but if not, vinegar will produce the desired result. If eggs have to be put in water, they should be rubbed dry after being taken out.

SHOP NOTES

HOME MADE SHOP HOIST.

A neat shop hoist, shown in the accompanying drawing, is described by the American Machinist, and can be built in almost any shop.



Easily Constructed Shop Hoist

A 15-inch I-beam is secured to the overhead beams, and this projects from the doorway about 9 feet. A trolley made up of steel plates is mounted on the I-beam, and to this are attached the two ends of a light wire rope, running over a pulley at the outer end of the beam and passing two or three times around a drum mounted at the inner end of the beam, this drum being operated by hand —to move the trolley in and out—by a chain passing over a sheave on the drum shaft. The hoisting and lowering are accomplished by power, the wire hoisting rope passing, in the manner indicated, from the hoisting drum to the outer end of the I-beam. The drum is driven in either direction through a cast-iron worm-wheel and worm, the latter being mounted on a shaft which is located near the floor and driven from the main line by open and crossed belts. These run on loose pulleys on the worm shaft when the hoist is idle, and by means of independent shippers, conveniently located, either belt is thrown on to the tight or driving pulley. The I-beam is, of course, rigidly secured to the overhead structure and the hoisting gear frame firmly attached to the beams under the floor. Added rigidity is also secured at this point by posts at either side of the driving gear. The gearing is well protected by a wood casing with a removable top.

HINTS TO INVENTORS.

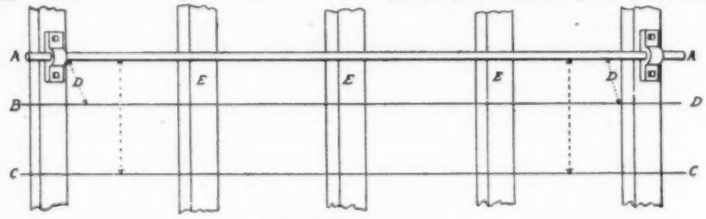
A prize of $100 is offered by the Society of Arts, Adelphi, W. C., London, England, for the best dust arresting respirator for use in dusty processes and dangerous trades. Inventors intending to compete must send sample and full description to reach the society before January 1, 1904.

A LIQUID PRIMARY BATTERY.

This German invention relates to a sealed liquid battery, which is as readily manipulated as a dry cell. The electrodes are zinc and carbon respectively. The carbon is supported by a porous cork, and has fitted to it a wooden disc provided with gas exit tubes. The tight closure of the cells is effected by rubber rings.

ALIGNING A SHAFT.

String two wires the whole length of the shaft (any kind of strong light wire), far enough from the shaft to avoid the largest pulleys, one wire in line with the shaft horizontally, the other directly above or below the shaft, says a writer in the Wood Worker. Make the ends of wires, after drawing them tight and fastening them securely, exactly the same distance from each end boxing of shaft. Perhaps the sketch will better explain it. A A is the line shaft, B B the wire on a level with the shaft. C C the wire strung below the shaft and directly under it. Let the dotted lines D D represent the exact distance of the wire B B from the end boxes of shaft. Having made the ends correct, then simply bring each boxing on every one of the posts E E E to the same exact distance from the wire. This aligns the shaft one way. Then, following the same plan in measuring up to shaft from lower wire C C will give a perfect alignment every time; no pulleys to be removed.



HOW IT IS DONE.

HOW TO MAKE AN OIL WELL BIT.

In making an oil well bit, which is primarily a battering and pulverizing tool, the cutting edge should be built with a very short bevel on the center of the bit, the outside being kept fairly sharp and acting as a rimmer to keep the hole to certain dimensions, according to Sparks From The Anvil. A good quality of steel must be used so that the bit will not batter when used and yet will be so tough as not to break under ordinary usage.

The first thing to do in the making of the bit is to make the shank or pin end. Some makers use axles, cutting them up and building what is known as a fagot, using as many pieces as may be necessary and welding them together into a bar, which is drawn into the shape of the top end of the bit. This is then cut off or left on the bar, the end being split; but previous to this process the steel is heated, drawn, and scarfed under a hammer in such a way that it can be locked into the end of the shank; it is then welded by taking a welding heat in the fire and drawing it down under the hammer. The welding should always be done in a fire that has plenty of coke under the bit, so that the cold blast cannot come through.

The blade is formed and a concave is put under the hammer with a pair of fullers, made in various shapes and according to the dimensions of the bit. The fullers must not be driven too cold for this spreads the bit and puts too much strain on the center which tends to pipe the bit or split it. As much as possible of the blade should be worked at one heating as this method gives an even quality to the steel all through. Care should be taken not to burn the steel, for this practically ruins it. After the blade is formed and the end cut off to the proper shape to be easily dressed, the bit is turned around and the shank is finished. The square is drawn to proper shape and size, the pin is drawn down, the collar is finished to the size needed to go to the lathe, and after being turned up, it is ready for use.

In making a bit from one piece of steel it is necessary to keep the fire at an even heat while working. The bit is drawn to any size and dimensions required.

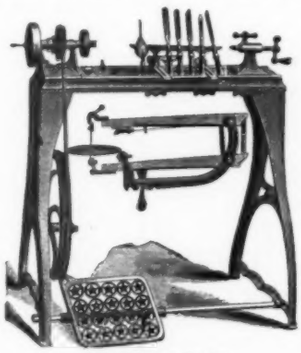
After the bits are turned and finished it is necessary to dress them to the proper size for the holes to be drilled, allowing a little clearance so that the body of the tool will not rub the edges of the well. After the final heat the bit is set in a shallow tub of water, covering only the very end of the bit, and hardened as hard as possible. Then it is drawn to the degree of hardness to suit the work required.

In Europe wattmeters are placed on electric cars, in some places, to measure the amount of current used. Prizes are given to economical motormen.

FOOT LATHE WITH SAW ATTACHMENTS.

One of the handiest foot power machines that the average shop can have is the combined foot lathe with scroll sawing attachment which can be easily put on or removed. This lathe which is made by Orr & Lockett, Chicago, is very inexpensive, but is patterned almost exactly after the most improved lathes of larger size in use in the best shops. To anyone working at home it is really indispensable.

The large driving wheel has two grooves of varying depths on its face, to give a change of speed, as the belt runs from it to the cone pulley on the lathe head. The lathe head is provided with a 2-inch face plate, a spur center, a screw center, for turning cups, and also a very nice drill chuck to hold from 1-32 to ¼ inch round twist drills for drilling wood or iron. It also has on the outer side of the pulley a 4½x⅞ inch solid emery wheel and a drill spindle, with a set screw to hold drill points for wood drilling. The tail stock has a screw-feed center, which is secured at any point by a clamping arrangement like that on the modern engine lathes. It is also provided with a long and short



Foot Power Lathe

tool rest, five turning tools, wrench, drill points, etc. Swing of lathe, 5 inches. Length of bed 24 inches. Distance between centers, 13½ inches.

This lathe is thoroughly built and highly finished, the planed and polished parts being nickel plated. Weight, 50 pounds.

For one dollar extra a circular saw can be obtained which really gives three machines in one. Power may be used where it is available.

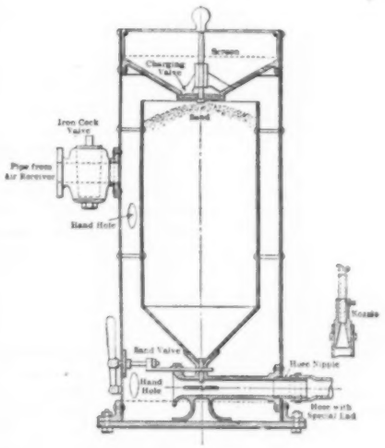
A FILE FOR BRASS.

A new type of file, specially devised for working upon gun metal, has been introduced into the engineering department of the Cremin de Fur du Nord, France. The feature of this tool which distinguishes it from the general type of file is a series of shallow channels which cross its face diagonally at an angle of 30 deg. and placed about half an inch apart. The raised portions of the surface of the file between these channels are occupied by the teeth of the tool. The advantages of the file are that it clogs less rapidly, and can easily and quickly be re-sharpened on the sand-blast, while it increases the work of the engineer who uses it in connection with gun metal filing, by 30 per cent.

Unequal shrinkage is what causes a piece of tool steel to crack in hardening.

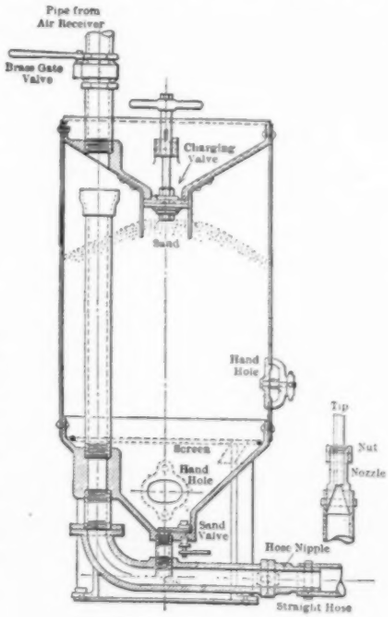
SAND BLAST FOR CLEANING STRUCTURAL STEEL.

The most effective way of cleaning steel plates and structural steel is by the sand blast. This method is the subject of an interesting article in Compressed Air, in which it is shown absolutely necessary for steel to be perfectly free from dirt and rust before being painted, else the paint does little or nothing towards preserving the steel.

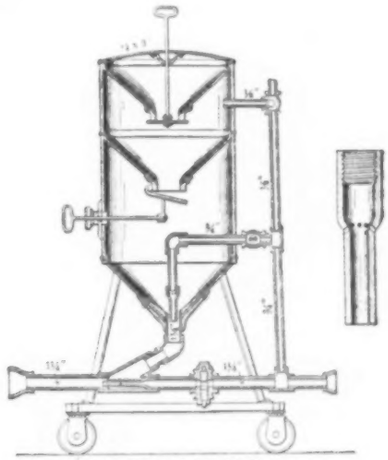


MATHEWSON'S SAND-BLAST.

The sand blast process consists of shooting sand by a current of compressed air against the steel, the force of the sand breaking up, wearing away and removing the substances against which it is directed. All the sand-blast machines are designed to secure the introduction of the proper proportion of sand into the current of compressed air, passing through a pipe. This current is directed through rubber hose and a steel or iron nozzle against the surface to be cleaned. The drawings show three sand blasts. In the first a slotted slide, worked by a lever, regulates the sand; in the second the regulator is a valve in the bottom of the hopper; and in the third



PAXSON-WARREN'S SAND-BLAST.



THE NEWHOUSE SAND-BLAST.

it is an annular opening. In the latter blast the nozzle is used as a siphon.

NEW WAY OF HARDENING STEEL.

W. H. Frith of London, one of the inventors of the Holzer-Frith process of hardening and annealing steel, declares that the present process of hardening steel by plunging and subsequent annealing will be abolished and all steel now in use, including armor plate, will shortly be obsolete.

By the new process hardening and annealing are accomplished simultaneously in a bath of quicksilver confined in a hermetically sealed vessel. The rapid expansion of the quicksilver under the influence of heat is said to create even pressure all around, and to prevent that distortion of the molecules which causes those flaws in steel as now hardened, which often lead to disaster where the product is subjected to severe tests.

Mr. Frith asserts that metal hardened and annealed by the quicksilver process is immensely increased in strength and will not rust. It is also asserted that ship plates and all exposed metal work can be made hard enough to resist rust and to offer extraordinary resistance to projectiles.

CLEAN THE PIPES.

Once a month it is a good plan to wash out the water pipes, water jacket and water tank with a strong solution of common soda or lye says the Motor Age. Let the motor run a few minutes before emptying the solution, then empty the tank and pipes and repeat the operation with clean water. This process will tend to insure uniformly effective circulation of the water.

HOW TO FIND HEATING SURFACE.

A convenient rule given by the Whitlock Coil Pipe Co. for finding the heating surface required in feed-water heaters, particularly of the coil type, where the circulation is rapid, is as follows: Divide the pounds of feed-water used per hour by 100 for copper, 90 for brass, and 60 for iron pipe. The quotient will represent the required square feet of heating surface.

Copper-Sheathed Warship

Process to Lessen Cost of Docking is Applied to the New Cruiser "Tacoma"

The new warship "Tacoma," recently launched, is the first of the larger type of vessels built in Pacific waters to be copper-sheathed. This sheathing is applied to the hull below the water line and is expected to diminish greatly the expense of docking to which all iron hull vessels are subject.

Instead of docking once in nine months as is customary, especially when navigating in tropical waters, it is believed that the copper-sheathed cruisers like the "Tacoma," will require cleaning not oftener than once in four years, her speed meantime not being impaired by marine growths. To test the advantages of sheathing is one of the objects of the "Tacoma." The experiment proved a success in the case of the small gunboats, Marietta and Wheeling.

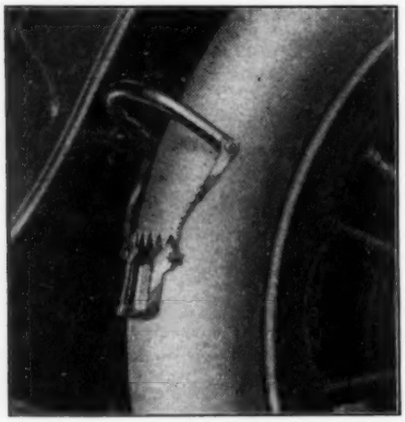
To apply the sheathing the immense hull of the "Tacoma" was covered with teak-wood planking, in strips from four to six inches wide and secured to the iron hull by copper screws. The interstices were caulked with oakum and thus rendered water-tight. Over this the sheathing was laid.

In the opinion of the naval constructors the combination of the two metals, aided by the action of sea-water, may result in decomposition of the hull from electrolysis, so that the result will be watched with great interest.

The "Tacoma" has a length of 292 feet; beam, 44 feet! mean draught, 15 feet; displacement, 3,200 tons; indicated horse power, 4,700; contracted speed, 16½ knots. Her coal bunkers have a capacity of 700 tons. Her engines are of 4-crank, triple-expansion type, with cylinders of 18, 29, 35½ and 35½ inches in diameter, with 30-inch stroke, making 175 revolutions with 225 pounds pressure. She has six boilers. The armament of the "Tacoma" includes ten 5-inch rapid firing rifles, eight 6-pounders, two 1-pounders, and four Colt's automatic guns. Her complement of officers and men numbers 311.

A NAIL EXTRACTOR.

A device, shown in the engraving, has been recently patented by the Howard Mfg. Co. of Attleboro, Mass., which has for its object the removal of nails or tacks from the tires after these have been



Keeps Nails From Tires

picked up on the road, and before the wheel has made a sufficient number of revolutions to force the foreign substance into the tire and cause a puncture. This device, we are informed, has been extensively used by automobilists and has proven satisfactory.

A London company contracts to clear docks, warehouses, etc. of rats. They use a preparation which,, they claim when eaten by the rats consumes the bodies of the animals, flesh and bone, obviating all stench from dead carcasses.

As high as $3.50 a day is earned by the strawberry picker in Oregon. Thousands of men, women and children engage in this work during the picking season.

BIDS FOR GREAT WAR VESSELS.

Newport News Co. Makes Lowest Offer—But One Bidder for Two Vessels.

Bids have been opened at the navy department for the construction of the Minnesota, Vermont and Kansas, the three 16,000-ton battleships authorized by the last congress, each to cost not less than $4,212,000.

The Newport News Shipbuilding Company of Newport, Va., was the lowest bidder for one vessel, the William Cramp & Son Ship and Engine Building Company was the only bidder for more than one ship. Following are the bids:

Newport News Shipbuilding Company, one vessel, department's plans, to be completed in forty-two months from date of contract, $4,110,000; William Cramp & Son Ship and Engine Building Company, one vessel, department's plans, to be completed in forty-two months, $4,190,000 ,or two vessels, department's plans, in the same time, $4,181,000 each; Fore River Ship and Engine Building Company, Quincy, Mass., one vessel, department's plans, forty-two months, $4,179,000; Eastern Shipbuilding Company, New London, Conn., one vessel, forty-two months, $4,192,000; New York Shipbuilding Company, one vessel, department's plans, forty-two months, $4,165,000.

It is supposed that the unsettled labor conditions throughout the country are the cause of the small number of bidders, and for the fact that only one company bid on more than one ship.

The A. Leschen & Sons Rope Company, the well-known wire rope and cordage manufacturers of St. Louis, have just issued a neat catalogue. In addition to displaying the wares of the firm the booklet contains many valuable hints as to the use and care of rope and some new ideas in the rope line.

Massachusetts has 431 miles of highway, built by the state.

TRAINS RUN THROUGH BUILDINGS.

This photograph is an illustration of a railway which was constructed through the center of a large building in New Brunswick, New Jersey, and for a number of weeks trains were run over it as shown by the photograph. The Pennsylvania Railroad Co. has been making improvements to its road bed in the city and changed its route so that several factories and other structures stood directly in the right of way. In order to save time, the engineers had holes knocked in the walls of some of these buildings and tracks laid through them

Railroad Through a Building

in order not to delay trains, the rest of the building being torn down later, while the road bed was completed. The building illustrated was located on a rise of ground so that one portion of the track was connected with the second story and the other end with the ground floor.

ELECTRICITY IN WARSHIPS.

The growth of the use of electricity in battleships is striking. In the United States navy the necessary electrical plant grew in five years from 7 watts per ton of displacement to 57 watts. Battleships of 12,000 tons require generating plant of about 350 kilowatts. In the new 16,000 tons ships there are two dynamo rooms at opposite ends of the vessel, each equipped with four generating sets of 100 kilowatts each. The generating sets are required to run satisfactorily for two hours with 33 1-3 per cent overload, and the temperature rise is limited to 33 1-3 deg. C. above the surrounding air, after four hours' run at full load.

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USES OF IRON AND STEEL SLAG.

Iron and steel slag (the waste cast off at blast furnaces) is now made to serve many valuable purposes of manufacture. Although the greater portion annually produced by iron and steel works is not available, a great deal is used in the manufacture of cement and of slag brick, as a fertilizer, and in the form of mineral wool; also to a less extent in the manufacture of paint stock, alum and glass, and a considerable quantity is disposed of less profitably as road material, railroad ballast and in land reclamation. Edwin C. Eckel, in a report of the United States Geological Survey, says:

"The most important uses of slag are in the manufacture of structural materials, especially hydraulic cements. Slag cement is produced by pulverizing, without calcination, a mixture of granulated basic blast-furnace slag and slaked lime. This product, although really a pozzuolanic cement, is usually marketed as "Portland cement," in spite of differing from pure Portland cement in manufacture, composition and properties. True Portland cement can be made from mixtures of which one element is blast-furnace slag, in which case the slag is ground, intimately mixed with powdered limestone and the mixture then calcined and reground."

KEEP A-GOIN.

If you strike a thorn or rose,
Keep a-goin!
If it hails or if it snows,
Keep a-goin!
'Taint no use to sit and whine,
When the fish ain't on your line,
Bait your hook and keep on tryin'—
Keep a-goin!

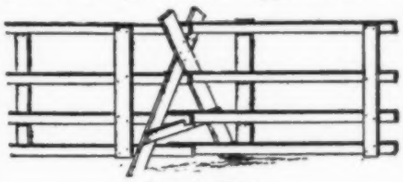
When the weather kills your crop,
Keep a-goin!
When you tumble from the top,
Keep a-goin!
S'pose you're out o' every dime,
Gettin' broke ain't any crime,
Tell the world you're feelin' prime!
Keep a-goin!

When it looks like all is up,
Keep a-goin!
Drain the sweetness from the cup,
Keep a-goin!
See the wild birds on the wing!
Hear the bells that sweetly ring!
When you feel like singin'—sing!
Keep a-goin!

—Frank L. Stanton.

A PRACTICAL PORTABLE FENCE.

A practical portable fence is easily made after a pattern shown in the illustration which is taken from the Ohio Farmer. The panels may be made any size. The lap ends are supported in the



Portable Fence

crotch of the X and the notch in the crosspiece beneath. Wire wrapped around the X and the lap will add further strength. At each end the fence is wired to a stake driven in the ground.

CONSERVATIVE LUMBERING A NECESSITY.

Available timber for lumber is growing scarce in the United States, and at an alarming rate when one stops to think about it. The splendid pine forests of the Upper Mississippi and the Great Lakes originally contained a stand of about 350,000,000,000 feet. Of this, so much timber has been cut that it is estimated that there now remains standing but 85,000,000,000 feet, exclusive of second growth. Of this amount, however, it is thought that not more than 35,000,000,000 feet is merchantable. Ten years more, according to some estimates, the white pine will disappear as an important factor in the lumber trade. The present stand of yellow pine, in the southern states, is placed at 137,000,000,000 feet so that this supply will also be exhausted before a second crop can be produced. A point has now been reached where lumbermen must look to a second crop on timbered lands if the industry of lumbering is to be continued in the not distant future. The government plan to assist the preservation of forests is conservative lumbering of forestry. It has long been a question with the lumbermen whether conservative lumbering pays, but in view of the decrease in the supply of timber it is coming to be recognized as a necessity.

The Brazilian government has given a subsidy to Senor Jose de Patrocini who will construct the largest air-ship yet attempted.

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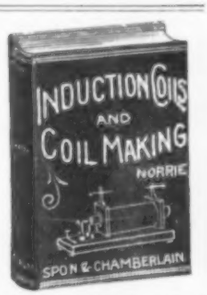

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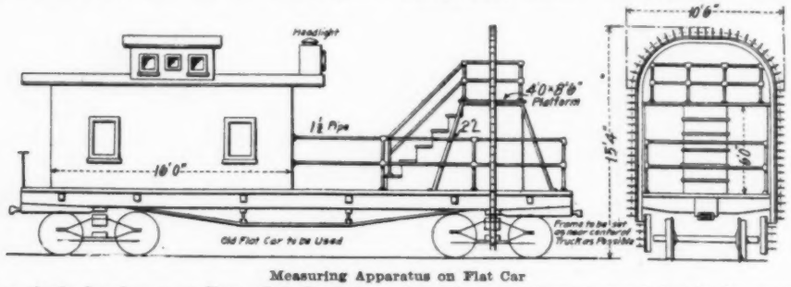
TUNNEL AND BRIDGE MEASURING CAR.

The Baltimore & Ohio Railroad has a tunnel and bridge measuring car which is described by the Railway Gazette. As shown in the drawing, it consists of a measuring apparatus mounted upon a flat car. At one end of this car is a caboose provided with bunks and equipment for a crew. A frame made of 4-in. T steel is placed over the front truck. The frame extends 14 ft. 8 in. above the rails and is 9 ft. 2 ins. wide. It is flat across the top for a distance of 2 ft. and then comes down to the sides on a quarter circle having a radius of 3 ft. 7 ins. This frame drops down alongside the car to a point about 18 ins. below the floor. Suspended to the lower end of this frame is another reaching to within a little less than a foot of the rails, but set in 7 ins. nearer the center upon each side, as shown in the end elevation of the drawing. Brackets, 69 sets in all, are riveted to the flange of the T at intervals of 6 ins. over the top and sides. By means of these the arms may be clamped in any position. These arms are 24 ins. long and have a graduated half circle at the base. The scaling of the half circle at the base of the pointer runs from 1 to 24 and indicates the distance that the end of the arm projects beyond the center of the pivot, when the line of the corresponding number coincides with the edge of the bracket where it joins the frame. As the center of each of these holes is accurately located and numbered, the corresponding point upon a tunnel or bridge is at once indicated when the end of the arm is brought into contact with it.

As the scaling reads both ways the car may be moved either way. Since the arms are held in place by friction the pointers can be set to any desired position for the inspection of new work, the measurement of old and any obstruction that comes within reach of the arms can be measured and located.



Measuring Apparatus on Flat Car

ODESSA TRADE IN DYNAMOS.

According to "Elektrotechnisher Anzeiger," Germany is the principal importer into Russia of dynamos and electric appliances. The other importing countries are Switzerland, France, England, Belgium, and America. Russia is manufacturing dynamos and electric appliances, but the cost of production is too high, and these can hardly compete with German makes, and, in consequence thereof, Russian makers confine themselves to the supply of auxiliaries, like cables, armatures, accumulators, etc. In 1901 incandescent lamps were imported from France and Holland, but, although offered at a cheap price, they were unable to wrest the market from the similar goods of German make, the latter being superior in quality. Austria does a good trade in carbon electrodes for arc lamps, while France holds her own against German competition in the matter of meters.

ENGINEERING PRIZES OFFERED.

The Austrian Minister of Commerce offers prizes of $20,300, $15,225, and $10,150 respectively for the three best designs submitted by engineers solving a problem in the building of the Danube-March-Oder canal. The problem is how to raise and lower canal boats in crossing the water shed between the heads of the March and Oder basins, with the least consumption of water and smallest expense. The elevation to be overcome is about 131 feet. In addition to the prize, a premium of $40,600 will be given to the person whose design is adopted when its success is demonstrated—provided the person has not been given charge of the construction. Plans and drawings must be filed not later than March 31, 1904. Copies of the minister's announcement, with full information, may by secured free from the Austro-Hungary embassy at Washington, or from the consulates at New York, Philadelphia, Pittsburg, Chicago and San Francisco.

The Norton Emery Wheel Company, Worcester, Mass., has issued an unusually interesting and instructive little book entitled "A Few Points on Grinding." This book will be sent free to all subscribers of Popular Mechanics who mention this paper in making the request.

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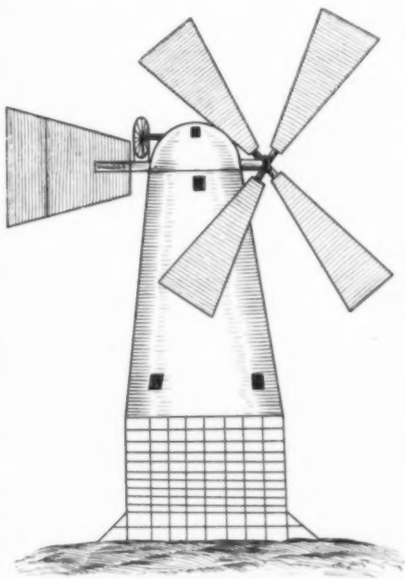
A HUGE WINDMILL.

One of the largest windmills in the west has just been completed on the beach at San Francisco to pump water to Golden Gate Park, a distance of two miles. The tower of the mill is 50 feet wide at the base and is firmly anchored down. It is 150 feet high. There are four immense sweeps or vanes, measuring 80 feet from center to outer end. They are made of heavy timber and to them are attached the cross-pieces that support the wings for catching the wind.



Great San Francisco Windmill

As a good wind always prevails on the beach, it is estimated that the mill will frequently attain a driving force of several hundred horse-power, enabling the pumping of hundreds of thousands of gallons of water daily.

JUST ABOUT NOW.

In the spring a thinner shadow haunts the young man's pocketbook and he casts upon each nickel a lean and hungry look. In the spring a brighter yellow blush is on the butterine and the boarders are suspicious of the azure-tinted cream. In the spring the festive angler from the ground extracts a worm and with fiendish glee impales it on a hook that makes it squirm. In the spring a woman's fancy turns to thoughts of stylish hats, while her weary, care-worn husband thinks a lot and murmurs "Fudge!" In the spring the jolly farmer with a chuckle doth begin painting letters on a shingle, "Summer Boarders Taken In." The bunko man is busy—the kite is on the string—thus we realize there's something doin' in the spring.

An eastern railroad company has contracted for four steel car floats to carry 23 50-ton freight cars on three tracks.

Butterflies which infest green houses and injure flowers are gotten rid of by smoke.

A New York firm makes glass models of underground workings. Everything is shown just as in the mine.

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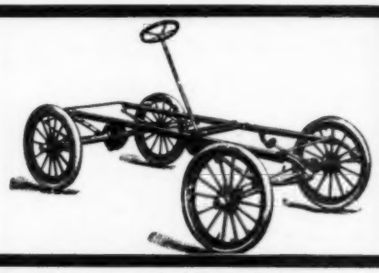

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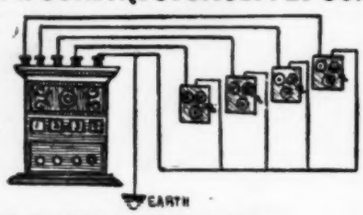

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